Claims

1. A method for inducing blood vessel formation or engineering blood vessels in a tissue or organ of a mammal, said method comprising administering one or more cells selected from the group consisting of preadipocytes, adipocytes not having a genetic modification, perivascular cells, vascular smooth muscle cells, mesenchymal precursor cells, mesenchymal cells, and fibroblasts to a tissue or organ of a mammal in need of increased blood vessel formation or engineered blood vessels.

2. The method of claim 1, wherein said mammal has a deficiency of at least 5% of a particular cell type.

3. The method of claim 1, wherein said mammal has damage to said tissue or organ, and wherein said administering provides a dose of cells sufficient to increase a biological function of said tissue or organ.

4. The method of claim 1, wherein said mammal has a disease, disorder, or condition, and wherein said administering provides a dose of cells sufficient to ameliorate or stabilize said disease, disorder, or condition.

5. The method of claim 1, wherein said preadipocyte is a 3T3-F442A cell.

6. The method of claim 1, wherein said mesenchymal precursor cell is a 10T1/2 cell.

7. The method of claim 1, further comprising administering to said mammal one or more cells selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, endothelial cell lines, primary culture endothelial cells, endothelial cells derived from stem cells, bone marrow derived stem cells, cord blood derived cells, HUVEC, lymphatic endothelial cells, and endothelial pregenitor cells.

8. The method of claim 7, wherein said one or more cells is a HUVEC cell.

9. The method of claim 1, further comprising administering a matrix to said mammal.

10. The method of claim 9, wherein said matrix comprises fibronectin.

11. The method of claim 9, wherein said matrix comprises collagen.

12. The method of claim 1, wherein said method increases the number of cells of said tissue or organ by at least 5% compared to a naturally-occurring corresponding control tissue or organ.

13. The method of claim 1, wherein said method increases the biological activity of a tissue or organ by at least 5% compared to a naturally-occurring corresponding control tissue or organ.

14. The method of claim 1, wherein said method increases blood vessel formation in said tissue or organ by at least 5% compared to a naturally-occurring corresponding control tissue or organ.

15. The method of claim 1, wherein said tissue or organ is selected from the group consisting of bladder, bone, brain, breast, cartilage, nervous tissue, esophagus, fallopian tube, heart, pancreas, intestines, gallbladder, kidney, liver, lung, ovaries, prostate, skeletal muscle, skin, spinal cord, spleen, stomach, testes, thymus, thyroid, trachea, urogenital tract, ureter, urethra, and uterus.

16. The method of claim 1, wherein said mammal is a human.

17. The method of claim 1, wherein said cells are part of a microvascular scaffold.

18. A method for increasing blood vessel formation or engineering blood vessels in a tissue or organ, said method comprising administering one or more cells selected from the group consisting of perivascular cells, vascular smooth muscle cells, mesenchymal precursor cells, mesenchymal cells, or fibroblasts to a tissue or organ in need of increased blood vessel formation or engineered blood vessels.

19. The method of claim 18, wherein said mesenchymal precursor cell is a 10T1/2 cell.

20. The method of claim 1 or 18, wherein said administering to said tissue or organ is carried out *in vivo*.

21. The method of claim 1 or 18, wherein said administering to said tissue or organ is carried out *ex vivo*.

22. The method of claim 18, further comprising administering to said tissue or organ one or more cells selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, endothelial cell lines, primary culture endothelial cells, endothelial cells derived from stem cells, bone marrow derived stem cells, cord blood derived cells, HUVEC, lymphatic endothelial cells, and endothelial pregenitor cells.

23. The method of claim 22, wherein said one or more cell is a HUVEC cell.

24. The method of claim 18, wherein said method further comprising administering a matrix to said tissue or organ.

25. The method of claim 18, wherein said tissue or organ is selected from the group consisting of bladder, bone, brain, breast, cartilage, nervous tissue, esophagus, fallopian tube, heart, pancreas, intestines, gallbladder, kidney, liver, lung, ovaries, prostate, skeletal muscle, skin, spinal cord, spleen, stomach, testes, thymus, thyroid, trachea, urogenital tract, ureter, urethra, and uterus.

26. The method of claim 18, wherein said method increases the number of cells of said tissue or organ by at least 5% compared to a naturally-occurring corresponding control tissue or organ.

27. The method of claim 18, wherein said method increases the biological activity of a tissue or organ by at least 5% compared to a naturally-occurring corresponding control tissue or organ.

28. The method of claim 18, wherein said method increases blood vessel formation in said tissue or organ by at least 5% compared to a naturally-occurring corresponding control tissue or organ.

29. A method for transplanting a tissue or organ in a mammal comprising administering to said mammal a tissue or organ having at least 5% more of one or more cells selected from the group consisting of preadipocytes, adipocytes not having a genetic modification, perivascular cells, vascular smooth muscle cells, mesenchymal precursor cells, mesenchymal cells, and fibroblasts than a naturally occurring control tissue or organ.

30. The method of claim 29, wherein said method further comprises administering an endothelial cell to said mammal.

31. The method of claim 30, wherein said endothelial cell is a heterologous endothelial cell.

32. The method of claim 30, wherein said endothelial cell is a HUVEC cell.

33. The method of claim 29, wherein said preadipocyte is a 3T3-F442A cell.

34. The method of claim 29, wherein said mesenchymal precursor cell is a 10T1/2 cell.

35. The method of claim 29, wherein said method further comprises administering a matrix to said mammal.

36. The method of claim 35, wherein said matrix comprises fibronectin.

37. The method of claim 35, wherein said matrix comprises collagen.

38. A method for producing a microvascular scaffold comprising culturing (i) a first cell selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, endothelial cell lines, and endothelial pregenitor cells, and (ii) a second cell selected from the group consisting of preadipocytes, adipocytes, and fibroblasts, under conditions that allow formation of a microvascular scaffold.

39. A method for producing a microvascular scaffold comprising culturing (i) a first cell selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, endothelial cell lines, and endothelial pregenitor cells, and (ii) a second cell selected from the group consisting of perivascular cells, vascular smooth muscle cells, mesenchymal precursor cells and mesenchymal cells, under conditions that allow formation of a microvascular scaffold.

40. The method of claim 38 or 39, wherein said endothelial cell is a HUVEC cell.

41. The method of claim 38, wherein said preadipocyte is a 3T3-F442A cell.

42. The method of claim 39, wherein said mesenchymal precursor cell is a 10T1/2 cell.

43. The method of claim 38 or 39, wherein said scaffold is produced *in vivo* or *ex vivo*.

44. The method of claim 38 or 39, wherein said first and second cells are cultured in the presence of a matrix.

45. The method of claim 38 or 39, wherein said first or second cells are cultured in the presence of a bioactive molecule that modulates angiogenesis.

46. The method of claim 38 or 39, wherein said first or second cells are genetically engineered to express a bioactive molecule that modulates angiogenesis.

47. The method of claim 45 or 46, wherein said bioactive molecule promotes angiogenesis.

48. The method of claim 45 or 46, wherein said bioactive molecule prevents angiogenesis.

49. The method of claim 45 or 46, wherein said bioactive molecule is selected from the group consisting of activin A, adrenomedullin, aFGF, ALK1, ALK5, ANF, angiogenin, angiopoietin-1, angiopoietin-2, angiopoietin-3, angiopoietin-4, angiostatin, angiotropin, angiotensin-2, AtT20-ECGF, betacellulin, bFGF, B61, bFGF inducing activity, cadherins, CAM-RF, cGMP analogs, ChDI, CLAF, claudins, collagen, collagen receptors $\alpha_1\beta_1$ and $\alpha_2\beta_1$, connexins, Cox-2, ECDGF (endothelial cell-derived growth factor), ECG, ECI, EDM, EGF, EMAP, endoglin, endothelins, endostatin, endothelial cell growth inhibitor, endothelial cell-viability maintaining factor, endothelial differentiation shpingolipid G-protein coupled receptor-1 (EDG1), ephrins,

Epo, HGF, TNF-alpha, TGF-beta, PD-ECGF, PDGF, IGF, IL8, growth hormone, fibrin fragment E, FGF-5, fibronectin and fibronectin receptor α5β1, Factor X, HB-EGF, HBNF, HGF, HUAF, heart derived inhibitor of vascular cell proliferation, IFN-gamma, IL1, IGF-2 IFN-gamma, integrin receptors, K-FGF, LIF, leiomyoma-derived growth factor, MCP-1, macrophage-derived growth factor, monocyte-derived growth factor, MD-ECI, MECIF, MMP 2, MMP3, MMP9, urokiase plasminogen activator, neuropilin (NRP1, NRP2), neurothelin, nitric oxide donors, nitric oxide synthases (NOSs), notch, occludins, zona occludins, oncostatin M, PDGF, PDGF- B, PDGF receptors, PDGFR-β, PD-ECGF, PAI-2, PD-ECGF, PF4, PlGF, PKR1, PKR2, PPARγ, PPARγ ligands, phosphodiesterase inhibitors, prolactin, prostacyclin, protein S, smooth muscle cell-derived growth factor, smooth muscle cell-derived migration factor, sphingosine-1-phosphate-1 (S1P1), Syk, SLP76, tachykinins, TGF-beta, Tie 1, Tie2, TGF-β, and TGF-β receptors, TIMPs, TNF-alpha, TNF-beta, transferrin, thrombospondin, urokinase, VEGF-A, VEGF-B, VEGF-C, VEGF-D, VEGF-E, VEGF, $VEGF_{164}$, VEGI, EG-VEGF, VEGF receptors, PF4, 16 kDa fragment of prolactin, prostaglandins E1 and E2, steroids, heparin, 1-butyryl glycerol (monobutyrin), and nicotinic amide.

50. A microvascular scaffold comprising (i) a first cell selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, or endothelial cell lines; and (ii) a second cell selected from the group consisting of preadipocytes, adipocytes and fibroblasts.

51. A perfused microvascular scaffold comprising (i) a first cell selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, and endothelial cell lines; and (ii) a second cell selected from the group consisting of perivascular cells, vascular smooth muscle cells, mesenchymal precursor cells and mesenchymal cells.

52. The scaffold of claim 50 or 51, wherein said endothelial cell is a HUVEC cell.

53. The scaffold of claim 50 or 51, further comprising a matrix.

54. The scaffold of claim 53, further comprising contacting said matrix with a bioactive molecule.

55. The scaffold of claim 50 or 51, further comprising a bioactive molecule.

56. The scaffold of claim 55, wherein said first or second cell is genetically engineered to express said bioactive molecule.

57. The scaffold of claim 54, 55, or 56, wherein said bioactive molecule is selected from the group consisting of activin A, adrenomedullin, aFGF, ALK1, ALK5, ANF, angiogenin, angiopoietin-1, angiopoietin-2, angiopoietin-3, angiopoietin-4, angiostatin, angiotropin, angiotensin-2, AtT20-ECGF, betacellulin, bFGF, B61, bFGF inducing activity, cadherins, CAM-RF, ChDI, cGMP analogs, CLAF, claudins, collagen, collagen receptors $\alpha_1\beta_1$ and $\alpha_2\beta_1$, connexins, Cox-2, ECDGF (endothelial cell-derived growth factor), ECG, ECI, EDM, EGF, EMAP, endoglin, endothelins, endostatin, endothelial cell growth inhibitor, endothelial cell-viability maintaining factor, endothelial differentiation shpingolipid G-protein coupled receptor-1 (EDG1), ephrins, Epo, HGF, TNF-alpha, TGF-beta, PD-ECGF, PDGF, IGF, IL8, growth hormone, fibrin fragment E, FGF-5, fibronectin and fibronectin receptor $\alpha5\beta1$, Factor X, HB-EGF, HBNF, HGF, HUAF, heart derived inhibitor of vascular cell proliferation, IFN-gamma, IL1, IGF-2 IFN-gamma, integrin receptors, K-FGF, LIF, leiomyoma-derived growth factor, MCP-1, macrophage-derived growth factor, monocyte-derived growth factor, MD-ECI, MECIF, MMP 2,

MMP3, MMP9, urokiase plasminogen activator, neuropilin (NRP1, NRP2), neurothelin, nitric oxide donors, nitric oxide synthases (NOSs), notch, occludins, zona occludins, oncostatin M, PDGF, PDGF- B, PDGF receptors, PDGFR-β, PD-ECGF, PAI-2, PD-ECGF, PF4, PlGF, PKR1, PKR2, PPARγ, PPARγ ligands, phosphodiesterase inhibitors, prolactin, prostacyclin, protein S, smooth muscle cell-derived growth factor, smooth muscle cell-derived migration factor, sphingosine-1-phosphate-1 (S1P1), Syk, SLP76, tachykinins, TGF-beta, Tie 1, Tie2, TGF-β, and TGF-β receptors, TIMPs, TNF-alpha, TNF-beta, transferrin, thrombospondin, urokinase, VEGF-A, VEGF-B, VEGF-C, VEGF-D, VEGF-E, VEGF, $VEGF_{164}$, VEGI, EG-VEGF, VEGF receptors, PF4, 16 kDa fragment of prolactin, prostaglandins E1 and E2, steroids, heparin, 1-butyryl glycerol (monobutyrin), and nicotinic amide.

58. The scaffold of claim 50 or 51, wherein the interstices of said scaffold further comprise a cell from the group consisting of skin cells, liver cells, heart cells, kidney cells, pancreatic cells, lung cells, bladder cells, stomach cells, intestinal cells, cells of the urogenital tract, breast cells, skeletal muscle cells, skin cells, bone cells, cartilage cells, keratinocytes, hepatocytes, gastro-intestinal cells, epithelial cells, endothelial cells, mammary cells, skeletal muscle cells, smooth muscle cells, parenchymal cells, osteoclasts, and chondrocytes.

59. The scaffold of claim 50 or 51, wherein said first or said second cell is genetically engineered to express a fluorescent protein.

60. The scaffold of claim 59, wherein said fluorescent protein is selected from the group consisting of GFP, EGFP, BFP, CFP, YFP, and RFP.

61. A tissue comprising a scaffold of claim 50 or 51.

62. A tissue having transplanted cells of a particular cell-type and having at least 5% more cells of said cell-type than a corresponding, naturally-occurring tissue, wherein said cell-type is selected from the group consisting of preadipocytes, adipocytes not having a genetic modification, perivascular cells, vascular smooth muscle cells, mesenchymal precursor cells, mesenchymal cells, and fibroblasts.

63. The tissue of claim 62, further comprising a transplanted cell selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, endothelial cell lines, primary culture endothelial cells, endothelial cells derived from stem cells, bone marrow derived stem cells, cord blood derived cells, HUVEC, lymphatic endothelial cells, and endothelial pregenitor cells.

64. The tissue of claim 61, having at least a 5% increase in blood vessel formation or engineered blood vessels after transplantion of said cells compared to a corresponding naturally-occurring tissue.

65. The tissue of claim 61, having at least a 5% increase in cell proliferation after transplantation of said cells compared to a corresponding naturally-occurring tissue.

66. The tissue of claim 61, wherein said tissue further comprises cells derived from the group consisting of bladder, bone, brain, breast, cartilage, nervous tissue, esophagus, fallopian tube, heart, pancreas, intestines, gallbladder, kidney, liver, lung, ovaries, prostate, skeletal muscle, skin, spinal cord, spleen, stomach, testes, thymus, thyroid, trachea, urogenital tract, ureter, urethra, and uterus.

67. The tissue of claim 61, having at least a 5% increase in biological function after transplantation of said cells compared to a corresponding naturally-occurring corresponding tissue.

68. The tissue of claim 67, wherein said biological function is digestion, excretion of waste, secretion, electrical activity, muscle activity, hormone production, or metabolic activity.

69. An organ comprising a tissue of claim 61 or 62.

70. A method of identifying a compound that modulates blood vessel formation, said method comprising the steps of

(a) culturing a first cell selected from the group consisting of blood vascular endothelial cells, lymph vascular endothelial cells, or endothelial cell lines; with a second cell selected from the group consisting of preadipocytes, adipocytes, perivascular cells, vascular smooth muscle cells, mesenchymal precursor cells, mesenchymal cells, and fibroblasts under conditions that allow blood vessel formation;

(b) contacting said culture of step (a) with a test compound;

(c) measuring said blood vessel formation in said culture; and

(d) determining whether blood vessel formation is modulated in said culture relative to a control culture not contacted with said test compound, thereby identifying a compound that modulates blood vessel formation.

71. The method of claim 70, wherein said test compound is present in a test mixture.

72. The method of claim 71, wherein said test mixture is a cell lysate.

73. The method of claim 71, wherein said test mixture is a lysate from a tissue.

74. The method of claim 71, wherein said test mixture is a library.

75. The method of claim 70, wherein said first and second cells are cultured in the presence of a matrix.

76. The method of claim 70, wherein said first and second cells are cultured in a tissue or an organ.

77. The method of claim 70, wherein said compound increases blood vessel formation.

78. The method of claim 70, wherein said compound decreases blood vessel formation.